

CLAIMS

What is claimed:

[c01] A nickel-based braze composition, comprising:

about 10 to about 25 atom % palladium; and

about 0.1 atom % to about 5 atom % (total) of at least one element selected from the group consisting of boron and silicon;

with the balance comprising nickel.

[c02] The composition of claim 1, wherein the level of palladium is about 12 atom % to about 20 atom %.

[c03] The composition of claim 1, wherein the level of boron is no greater than about 2 atom %.

[c04] The composition of claim 1, wherein the level of silicon is in the range of about 2 atom % to about 5 atom %.

[c05] The composition of claim 1, further comprising at least one element selected from the group consisting of tantalum, titanium, and zirconium.

[c06] The composition of claim 5, wherein the total amount of tantalum, titanium and zirconium present is in the range of about 0.1 atom % to about 40 atom %.

[c07] The composition of claim 6, wherein the total amount of tantalum, titanium and zirconium present is in the range of about 1 atom % to about 15 atom %.

[c08] The composition of claim 1, further comprising at least one element selected from the group consisting of aluminum and chromium.

[c09] The composition of claim 8, wherein the amount of aluminum present is in the range of about 0.5 atom % to about 16 atom %.

[c10] The composition of claim 8, wherein the amount of chromium present is in the range of about 0.5 atom % to about 15 atom %.

[c11] The composition of claim 1, further comprising cobalt.

[c12] The composition of claim 11, wherein cobalt is present at a level in the range of about 1 atom % to about 15 atom %.

[c13] The composition of claim 1, further comprising at least one element selected from the group consisting of carbon, molybdenum, tungsten, rhenium, and iron.

[c14] The composition of claim 13, wherein each element selected from the group consisting of carbon, molybdenum, tungsten, iron, and rhenium is optionally present at a level no greater than about 3 atom %.

[c15] The composition of claim 1, further comprising at least one element selected from the group consisting of tantalum, titanium, zirconium, aluminum and chromium.

[c16] The composition of claim 15, wherein tantalum, titanium, zirconium, aluminum and chromium are optionally present at levels sufficient to achieve a braze liquidus of no greater than about 1230°C.

[c17] A nickel-based braze composition, comprising:

about 12 to about 20 atom % palladium;

about 0.1 atom % to about 5 atom % (total) of at least one element selected from the group consisting of boron and silicon;

about 0.1 atom % to about 40 atom % (total) of at least one element selected from the group consisting of tantalum, titanium and zirconium;

with the balance comprising nickel.

[c18] A nickel-based braze composition, comprising:

about 12 to about 20 atom % palladium;

about 0.1 atom % to about 5 atom % (total) of at least one element selected from the group consisting of boron and silicon;

about 1 atom % to about 15 atom % (total) of at least one element selected from the group consisting of tantalum, titanium and zirconium;

about 0.5 atom % to about 16 atom % of aluminum;

about 0.5 atom % to about 15 atom % chromium;

with the balance comprising nickel.

[c19] A method for joining two metal components formed of nickel-based alloys, comprising the following steps:

a) placing a joint-forming amount of a braze composition between the metal components which have been positioned in a close-fitting arrangement, wherein the braze composition comprises:

about 10 to about 25 atom % palladium; and

about 0.1 atom % to about 5 atom % (total) of at least one element selected from the group consisting of boron and silicon;

with the balance comprising nickel;

b) heating the braze composition to a brazing temperature sufficient to melt the composition but not the metal components; and

c) cooling the braze composition so that it re-solidifies and forms a joint between the components.

[c20] The method of claim 19, wherein the braze composition further comprises at least one constituent selected from the group consisting of binders, solvents, dispersants, wetting agents, deflocculants, stabilizers, anti-settling agents, thickening agents, plasticizers, emollients, lubricants, surfactants, anti-foam agents, and curing modifiers.

[c21] The method of claim 19, wherein the braze composition is in the form of a tape, foil, wire, powder, slurry, or putty.

[c22] The method of claim 19, wherein step (b) is carried out in a vacuum furnace.

[c23] The method of claim 19, wherein the braze composition further comprises at least one element selected from the group consisting of tantalum, titanium, and zirconium, wherein the total amount of tantalum, titanium and zirconium present is in the range of about 0.1 atom % to about 40 atom %.

[c24] The method of claim 19, wherein the braze composition further comprises at least one element selected from the group consisting of aluminum and chromium.

[c25] A method for filling a cavity in a component formed of a nickel-based superalloy material, comprising the following steps:

(I) incorporating a braze composition into the cavity, wherein the braze composition is a first metal powder which comprises:

about 10 to about 25 atom % palladium; and

about 0.1 atom % to about 5 atom % (total) of at least one element selected from the group consisting of boron and silicon;

with the balance comprising nickel;

(II) heating the braze composition to a brazing temperature sufficient to melt the composition and to cause it to flow and completely fill the cavity, while not melting any surrounding material of the component; and

(III) cooling the braze composition so that it re-solidifies within the cavity.

[c26] The method of claim 25, wherein the cavity is a crack, and the braze composition is in the form of a slurry.

[c27] The method of claim 25, wherein the braze composition further comprises at least one element selected from the group consisting of tantalum, titanium, and zirconium, wherein the total amount of tantalum, titanium and zirconium present is in the range of about 0.1 atom % to about 40 atom %.

[c28] The method of claim 25, wherein the braze composition further comprises at least one element selected from the group consisting of aluminum and chromium.

[c29] The method of claim 25, wherein the braze composition further comprises a second metal powder, having a melting point different from that of the first metal powder.

[c30] A superalloy component joined to another metal component with the nickel-based braze composition of claim 1.

[c31] A superalloy article having at least one cavity filled with the nickel-based braze composition of claim 1.